



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/809,809	03/26/2004	Tetsuya Ikuta	042278	7816
38834	7590	12/09/2005	EXAMINER	
WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP			LE, THAO X	
1250 CONNECTICUT AVENUE, NW			ART UNIT	
SUITE 700			PAPER NUMBER	
WASHINGTON, DC 20036			2814	

DATE MAILED: 12/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

H.A.

Office Action Summary	Application No.	Applicant(s)	
	10/809,809	IKUTA ET AL.	
	Examiner	Art Unit	
	Thao X. Le	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 July 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 1-9 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 9-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 March 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>03/26/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Election/Restrictions

2. Applicant's election without traverse of claims 9-20 in the reply filed on 07 July 2005 is acknowledged.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 9-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 6133605 to Kishi.

Regarding claim 9, Kishi discloses a manufacturing method of a semiconductor device in fig. 6-15 comprising the steps of: forming a gate insulation film 31, fig. 11 over a silicon substrate 1; and forming a gate electrode 9 over said gate insulation film 31, said step of forming a gate insulation film 31 including the steps of: forming a silicon oxide film 24, column 8 line 67, over said silicon substrate 1, column 6 line 43 (inherently semiconductor comprises silicon); and introducing nitrogen, column 9 line 4, into said silicon oxide film 24 and displacing silicon atoms on a surface of said silicon substrate toward said gate insulation film side, fig. 9.

But, Kishi does not disclose the silicon oxide film 24 is 1.5 nm or less.

However, Kishi discloses the method wherein said silicon oxide film 24 is 2.2 nm in thickness, column 9 line 3. Accordingly, it would have been obvious to one of ordinary skill in art to use the silicon oxide thickness teaching of Kishi in the range as claimed, because it has been held that where the general conditions of the claims are disclosed in the prior art, it is not inventive to discover the optimum or workable range by routine experimentation. See *In re Aller*, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955).

The recitation of 'displacing silicon atoms on a surface of said silicon substrate toward said gate insulation film side', Kishi discloses a products that are produced by identical or substantially identical processes, a *prima facie* case

of either anticipation or obviousness has been established. *In re Best*, 195 USPQ 430, 433 (CCPA 1977) and MPEP 2112.01.

Regarding claim 10, Kishi discloses the method according to claim 9, wherein said step of introducing nitrogen and displacing silicon atoms comprises the step of conducting a first heat treatment, column 9 line 5, to said silicon oxide film 24 in an ammonia atmosphere or nitrogen monoxide atmosphere, column 9 line 5.

Regarding claim 11, Kishi discloses the method according to claim 9, wherein said gate insulation film 31 is formed over a region where a conductive type of said surface of said silicon substrate 1 is P-type, column 6 line 44.

Regarding claim 12, Kishi discloses a manufacturing method of a semiconductor device in fig. 6-15 comprising the steps of: forming a gate insulation film 31, fig. 11, over a silicon substrate 1; and forming a gate electrode 9 over said gate insulation film 31, said step of forming a gate insulation film including the steps of: forming a silicon oxide film 24 over said silicon substrate 1; and introducing nitrogen, column 9 line 4, into said silicon oxide film 24, displacing silicon atoms on a surface of said silicon substrate in a region where a conductive type of said surface is P-type, column 6 line 44, below said gate insulation film 31 toward said gate insulation film side, and displacing silicon atoms on said surface in a region where said conductive type of said surface is N-type 10, column 10 line 3, below said gate insulation film 31 toward an inner side of said silicon substrate 1.

But, Kishi does not disclose the silicon oxide film 24 is 1.5 nm or less.

However, Kishi discloses the method wherein said silicon oxide film 24 is 2.2 nm in thickness, column 9 line 3. Accordingly, it would have been obvious to one of ordinary skill in art to use the silicon oxide thickness teaching of Kishi in the range as claimed, because it has been held that where the general conditions of the claims are disclosed in the prior art, it is not inventive to discover the optimum or workable range by routine experimentation. See *In re Aller*, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955).

The recitation of 'displacing silicon atoms on a surface of said silicon substrate toward said gate insulation film side', Kishi discloses a products that are produced by identical or substantially identical processes, a *prima facie* case of either anticipation or obviousness has been established. *In re Best*, 195 USPQ 430, 433 (CCPA 1977) and MPEP 2112.01.

Regarding claim 13, Kishi discloses the method according to claim 12, wherein said step of introducing nitrogen and displacing silicon atoms comprises the step of conducting a first heat treatment, column 9 line 5, to said silicon oxide film 24 in an ammonia atmosphere or nitrogen monoxide atmosphere, column 9 line 5, in said region where the conductive type of said surface is P-type, and conducting a plasma nitridation treatment, column 9 lines 4-8, to said silicon oxide film 24 in an ammonia atmosphere or nitrogen monoxide atmosphere, column 9 line 5, in said region where the conductive type of said surface is N-type 10.

Regarding claim 14, Kishi discloses the method according to claim 10, wherein said first heat treatment is conducted at 775 degree C or higher, column 9 line 5.

Regarding claim 15, Kishi discloses the method according to claim 9, wherein said step of forming a gate insulation film 31 comprises the step of forming a silicon nitride film 4, column 9 line 10, or high dielectric constant film over said silicon oxide film, after said step of introducing nitrogen and displacing silicon atoms, fig. 10.

Regarding claim 16, Kishi discloses the method according to claim 15, wherein said step of forming a gate insulation film 31 comprises the step of conducting a second heat treatment, column 9 line 8, 28 or 31, to said silicon oxide film, to which nitrogen has been introduced, after said step of forming a silicon nitride film or high dielectric constant film.

Regarding claim 17, Kishi discloses the method according to claim 16, wherein said second heat treatment is conducted at a higher temperature than that at which said silicon nitride film or high dielectric constant film is formed, column 9 line 31.

Regarding claim 18, Kishi discloses the method according to claim 9, wherein said step of forming a gate insulation film 31 comprises the steps of, after said step of introducing nitrogen and displacing silicon atoms: forming a high dielectric constant film over said silicon oxide film 24; conducting a second heat treatment to said silicon oxide film, column 9 line 8, to which nitrogen has been introduced; and forming a silicon nitride film 4, column 9 line 10 over said high dielectric constant film.

Regarding claim 19, Kishi discloses the method according to claim 16, wherein said second heat treatment is conducted in a nitrogen monoxide atmosphere, column 9 line 9.

Response to Arguments

6. Applicant's arguments filed 09 Nov. 2005 have been fully considered but they are not persuasive. The Applicant argues that the use of a silicon oxide film of 1.5 nm or less provided unexpected results. When the thickness of the SiO film is 1.5 or less, the subsequent introduction of nitrogen into the SiO film can cause disorder in the film. On the other hand, thickness of the SiO of Kishi is set to 2.2 nm, a subsequent heat treatment in an ammonia atmosphere cannot cause enough disorder in the SiO film to generate an intended interface strain. This is not persuasive because

- a. The Applicant admits in the record that the SiO film of Kishi would have disorder due to the nitridation process. Thus, the Examiner submits that the SiO oxide layer of Kishi would obviously have unexpected results, i.e. disorder in the SiO film.
- b. In response to applicant's argument that the references fail to show certain features of applicant's invention); it is noted that the features upon which applicant relies on, i.e. the degree of disorder and interface face, are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).
- c. In addition, the arguments of counsel cannot take the place of evidence in the record. *In re Schulze*, 346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965). Examples of attorney statements which are not evidence and which must be supported by an appropriate affidavit or declaration include statements regarding

unexpected results, commercial success, solution of a long-felt need, inoperability of the prior art, invention before the date of the reference, and allegations that the author(s) of the prior art derived the disclosed subject matter from the applicant.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

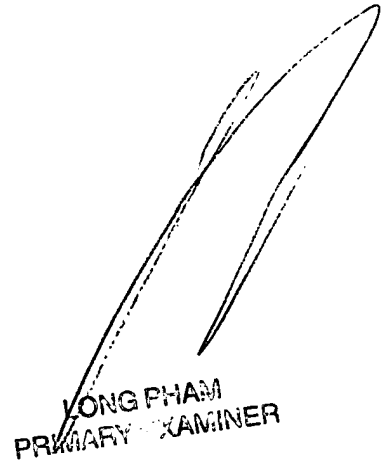
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao X. Le whose telephone number is (571) 272-1708. The examiner can normally be reached on M-F from 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M. Fahmy can be reached on (571) 272 -1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Thao X. Le
Patent Examiner
05 Dec. 2005



LONG PHAM
PRIMARY EXAMINER